L 13716-66 EWT(m)/EWP(t)/ETI IJP(c) GG/JW/JG/JD

ACC NR: AP6030666 SOURCE CODE: UR/0166/66/000/004/0046/0049 65 B

AUTHOR: Zavadovskaya, Ye. K.; Blaunshteyn, I. M.; Timoshenko, I. M.

ORG: Tomsk Polytechnic Institute (Tomskiy politekhnicheskiy institut)

TITLE: On radiation resistance by fluorides of alkali earth metals 27

SOURCE: AN UzSSR. Izvestiya. Seriya fiziko-matematicheskikh nauk, no. 4, 1966, 46-49 27

TOPIC TAGS: radiation effect, radiation damage, gas absorption, desorption, gas adsorption, ALKALI METAL, GAMMA RAY ABSORPTION

ABSTRACT: An investigation was made of the energy absorbed and stored by CaF_2, SrF_2, and BaF_2 irradiated with gamma-rays. The absorbed energy can be spent on luminescence and radiolysis due to irradiation. Considerably less energy was stored in BaF_2 than in CaF_2 (the material with the higher lattice energy). Since at equal radiation doses the amount of energy stored in CaF_2 is greater than in BaF_2, it can be assumed that the former spends less energy on radiolysis and, consequently, accumulates fewer radiolysis products. The process of radiolysis was investigated on the basis of the absorption and desorption of gases during irradiation and annealing. The most intensive absorption of gas by CaF_2 occurred at doses up to 20 million roentgens; saturation

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was reached at larger doses. The absorption in SrF_2 was similar. The irradiation of BaF_2 was followed by gas desorption. The greatest desorption in BaF_2 was at doses of the order of 40 million roentgens. During thermal annealing of CaF_2 an induction period was first observed which was followed by gas desorption at 124C; further heating led to gas absorption at 223C and intensive gas desorption at 360C. An induction period was also first observed in SrF_2 which was followed by gas desorption at 100—120C, partial restoration of vacuum at 200—225C, and intensive gas desorption at 276C. During the annealing of BaF_2 the gas desorbed intensively at 180—200C. The quantity of desorbed gas after the annealing of an irradiated material depends on the chemical composition of the material. With a decrease in the lattice binding energy and an increase in the cation radius, the quantity of gas desorbed during annealing increases and the temperature of intensive gas desorption decreases. Orig. art. has: 3 figures and 1 table. [JA]

SUB CODE: 20/ SUBM DATE: 05Jul65/ ORIG REF: 005/ ATD PRESS: 5[illegible]4

ZAVADOVSKAYA, Ye.K.; KUZ'MINA, A.V.

Measurement of the energy stored in LiF crystals following ionizing irradiation at room temperature. Fiz. tver. tela 6 no.11:3348-3350 N '64. (MIRA 18:1)

1. Tomskiy politekhnicheskiy institut.

ZAVADOVSKAYA, Ye.K.; KOCHERBAYEV, T.K.

Electric strength of single crystals in solid solutions of the system KCl- KBr. Izv. vys. ucheb. zav.; fiz. 8 no.1:69-72 '65. (MIRA 18:3)

1. Tomskiy politekhnicheskiy institut imeni Kirova.

ZAVADOVSKAYA, Ye.K.; KUZ'MINA, A.V.

Value of the energy stored in crystals of the alkali halides NaCl, KCl, KBr, and KI following γ-irradiation at room temperature. Izv. vys. ucheb. zav.; fiz. 8 no.1:175-176 '65. (MIRA 18:3)

1. Tomskiy politekhnicheskiy institut imeni Kirova.

MELIK-GAYKAZYAN, I.Ya.; ZAVALOVSKAYA, Ye.K.; IGNAT'YEVA, M.I.

Change in the electroconductivity of KCl crystals with divalent impurities following X-ray irradiation. Fiz. tver. tela 6 no.4: 1243-1246 Ap '64. (MIRA 17:6)

1. Tomskiy politekhnicheskiy institut.

S/0181/64/006/004/1243/1246

ACCESSION NR: AP4028465

AUTHORS: Melik-Gaykazyan, I. Ya.; Zavadovskaya, Ye. K.; Ignat'yeva, M. I.

TITLE: Change in electrical conductivity of KCl crystals on addition of bivalent impurities after x-ray irradiation

SOURCE: Fizika tverdogo tela, v. 6, no. 4, 1964, 1243-1246

TOPIC TAGS: conductivity, electrical conductivity, KCl, KCl crystal, x-ray, F center, Pb doped KCl, Sr doped KCl, F center density, impurity, impurity concentration, current carrier, hole center

ABSTRACT: The authors have studied the ionic conductivity, its radiation change during equal doses of x-irradiation ($\sim 4 \cdot 10^4$ roentgens) in KCl·Pb and KCl·Sr crystals, and the density of F centers in KCl·Sr. Pb and Sr impurities have altogether different acceptor properties relative to holes. Pb^{2+} in NaCl is an acceptor of electrons, but Sr^{2+} in KCl gives rise to activator hole centers. In KCl a comparatively small increase in electrical conductivity accompanying the injection of Sr up to $2 \cdot 10^{-2}$ molecular percent corresponds to an increase in F

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ACCESSION NR: AP4028465

centers of 210%. The maximum increase in density of F centers in KCl activated by Pb does not exceed 70%. Changes in conductivity with changes in impurity concentration indicate that the first are observed only in the interval of concentration for which a change in conductivity in nonirradiated crystals takes place. Conductivity in a crystal affects radiation change only at those impurities situated in regular points of the crystal lattice. Increased radiation changes in the conductivity of KCl-Pb are observed, first, through decrease in number of current carriers arising during localization of holes at single ion vacancies and, second, because of increased stability of hole centers that have formed through the appearance of electron atomic centers. Orig. art. has: 2 figures.

ASSOCIATION: Tomskiy politekhnicheskiy institut (Tomsk Polytechnical Institute)

SUBMITTED: 29Jul63 DATE ACQ: 27Apr64 ENCL: 00

SUB CODE: PH NO REF SOV: 001 OTHER: 005

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IGNAT'YEVA, M.I.; ZAVADOVSKAYA, Yo.K.; MELIK-GAYKAZYAN, I.Ya.

Effect of divalent impurities on the radiation stability of alkali halide crystals. Fiz. tver. tela 5 no.10:2775-2779 O '63. (MIRA 16:11)

1. Tomskiy politekhnicheskiy institut.

TRESKINA, M.N.; ZAVADOVSKAYA, Ye.K.

Variations in the properties of solid solutions of alkali halide compounds in the process of natural aging. Izv. vys. ucheb. zav.; fiz. no.5:3-9 '62. (MIRA 15:12)

1. Tomskiy politekhnicheskiy institut imeni S.M. Kirova.
(Alkali metal halides)
(Solutions, Solid)

DRUZHININA, Z.I.; ZAVADOVSKAYA, Ye.K.; STEBNITSKAYA, G.V.

Ionic electric conductivity of single crystals in solid solutions and mechanical mixtures of alkali metal halides. Izv. TPI 95: 217-225 '58. (MIRA 14:9)

(Solutions, Solid--Electric porperties)
(Alkali metal halides--Electric properties)

TRESKINA, M.N.; ZAVADOVSKAYA, Ye.K.

Some properties of solid solutions of the system KCl - KBr in connection with its defect structure. Izv.vys.ucheb.zav.; fiz. no.2:55-59 '61. (MIRA 14:7)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Potassium halides) (Solutions, Solid)

ZAVADOVSKAYA, Ye.K.; TRESKINA, M.N.; MELIK-GAYKAZYAN, I.Ya.

Effect of impurities on the electroconductivity and absorption spectra of alkali halide crystals. Izv.vys.ucheb.zav.; fiz. no.2: 66-70 '61. (MIRA 14:7)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Alkali halide crystals)

ZAVADOVSKAYA, Ye.K.; TRESKINA, M.N.

Measurement of the electric conductivity of solid dielectrics over a wide temperature range. Zav.lab. 27 no.5:596-572 '61. (MIRA 14:5)

1. Tomskiy politekhnicheskiy institut imeni S. M. Kirova.
(Dielectrics)

S/058/61/000/007/024/086
A001/A101

AUTHORS: Melik-Gaykazyan, I.Ya., Treskina, M.N., Zavadovskaya, Ye.K.

TITLE: Dependence of F-center density and half-width of F-band on the composition of KCl-KBr mixed crystals

PERIODICAL: Referativnyy zhurnal. Fizika, no. 7, 1961, 140, abstract 7V304 ("Dokl. Mezhvuz. nauchn. konferentsii po spektroskopii i spektr. analizu". Tomsk, Tomskiy-un-t, 1960, 119 - 121)

TEXT: The authors investigated the F-band of absorption in KCl-KBr mixed crystals of variable composition grown from the smelt and from the solution. Maximum deviations of the half-width of the F-band from the additive value is observed in the compound consisting of 80 mol. per cent KBr in KCl. The largest concentration of Schottky defects corresponds to the same composition; this apparently explained the deviation of the half-width of the F-band from the additive value. Concentration of F-centers in KCl-KBr crystals is lower than in pure crystals of KCl and KBr. It is possible that the lesser stability of F-centers in solid solutions is caused by asymmetry of surroundings of the color

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Dependence of F-center density ...

center and increased density of dislocations in the mixed crystal. An inverse dependence of F-center stability on thermal luminescence and density of F-centers is established.

E. Nagayev

[Abstracter's note: Complete translation]

Card 2/2

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9.4300 (1145, 1147, 1155)
24.7800 1043, 1144, 1160

S/063/60/005/005/012/021
A051/A029

AUTHORS: Vorob'yev, A.A., Professor, Zavadovskaya, Ye.K., Professor, Boldyrev, V.V., Candidate of Chemical Sciences, Melik-Gaykazyan, I.Ya., Candidate of Physical and Mathematical Sciences, Savintsev, P.A., Candidate of Physical and Mathematical Sciences

TITLE: Physico-Chemical Problems of Dielectrics

PERIODICAL: Zhurnal Vsesoyuznogo Khimicheskogo Obshchestva im. D.I. Mendeleyeva, 1960, No. 5, Vol. 5, pp. 573-582

TEXT: Dielectrical materials should have a high thermal, chemical and radiation resistance, a high mechanical and electrical strength, in some cases they should have a low value of the angle of losses, a low electroconductivity and a high dielectrical constant (Ref. 1). Some of the more recent fields of application are scintillation counters, where the dielectrics with a large width of the forbidden zone of energy are used, or in explosives (Ref. 2), where the electronic and ionic processes which occasionally take

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S/063/60/005/005/012/021
A051/A029

Physico-Chemical Problems of Dielectrics

place in the dielectrics are applied. In outlining the physico-chemical properties of dielectrics, the connection between these properties are discussed in reference to the energy of the lattice. It is pointed out that, since little is known of the physical processes in dielectrics when acted upon by an electrical field, chemistry and the science of electrical materials is mostly empirical. The physical properties of dielectrics in relation to their chemical composition and structure were studied. The dielectrical properties of simple substances with a known chemical composition were investigated (Ref. 1,4-24). It was found that the main properties of the dielectrics (thermal resistance, binding energy of the electron in the lattice, mechanical strength, optical properties, etc.), were directly determined by the strength and nature of the particle bond in the lattice. Under the effect of external conditions the interaction energy between these particles can be overcome and the lattice destroyed. A number of graphs are presented indicating how the various properties are affected by the lattice energy, i. e., the energy value necessary to divide the crystal lattice, consisting of ions, to individual ions and separation of these from one another to an infinitely large distance at a temperature of absolute zero. The case of binary ionic compounds of the A_mB_n type, as described by Kapustinskiy (Ref. 25),

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S/063/60/005/005/012/021
A051/A029

is given where the calculation of the energy of the lattices with a coordination number 6, is estimated according to formula (1): $U = 256.1 \frac{(a+b)W_A \cdot W_B}{R_A + R_B}$, where a is the number of cations, b the number of anions, W_A and W_B the valencies of the anion and the cation, R_A and R_B the radii of the corresponding ions for the structure of a lattice of the sodium chloride type. A later version of the formula, where also the repulsion, as well as the attraction of the ions is considered, is given as: $U = 287.2 \frac{W_A \cdot W_B (a+b)}{R_A + R_B} (1 - \frac{0.345}{R_A + R_B})$ (2). The ionic crystals have a high value of lattice energy and thus also a high value of thermal and mechanical strength. In the case of isodesmic ionic lattices of the same structural type, the properties of the materials are connected with the energy of the crystal lattice determined by the chemical composition. Fig.1 is a graphical representation of the effect of the hardness according to Moos, melting point, electrical strength of the ionic crystals by the lattice energy, Fig.2 shows the same relationship for alkali earth metal oxides. From equation 1 it is seen that with a decrease in the size of the particles, which make up

the lattice, the lattice energy increases. Fig.3 represents the relationship between the change in volume of an elementary nucleus of a molecule (Ref.3) in various compounds according to data from X-ray analyses, and the lattice energy for crystals of alkali-halide compounds. Fig.4 gives the relationship of the number of ions n in one cm^3 to the lattice energy for crystals of alkali-halide salts. The value of n was determined from:

$n = \frac{N \cdot d}{2(A_1 + A_2)}$ (3), where N is = $6.06 \cdot 10^{23}$, d the specific gravity, A_1 and A_2 atomic weights of the ions. The specific thermal capacity c_p, at a constant pressure, is given in Fig.5 in relation to the lattice energy, and Fig.6 shows the relationship of the melting heat to the lattice energy. Experiments showed that the optical properties of ionic crystals also depend on the lattice energy. With an increase in the latter, the absorption of light changes in the infrared, visible and ultraviolet regions according to certain rules. The electronic polarizability in relation to the lattice energy for alkaline halides is shown in Fig.8 (Ref.30,31). A decrease or an increase of the dielectrical constant and of its components will be noted due to the shift in the ions corresponding to the change in the ion polarizability of the ions and their concentration with a change in the lattice energy. Fig.9 repre-

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sents the change in the electronic component of the dielectrical constant with a change in the lattice energy for crystals of the alkali-halide compound series. The relationship of the electroconductivity to the temperature of ionic crystals is described by the formula:

$\sigma = \sigma_1 e^{-u_1/kT} + \sigma_2 e^{-u_2/kT}$, where u is the activation energy of the liberation processes of the ions in the lattice. Experimental data showed that a significant increase of the high-temperature range of the activation energy takes place with an increase in the lattice energy of the alkali-halide salt crystals. The sum of the activation energies at low and high temperatures was found to depend on the lattice energy. The conclusion is drawn here that the electroconductivity of the crystals is connected with the energy of the crystal lattice in a law sequence. Other properties, such as the effective mass of the electron and the magnitude of the oscillating quantum, are also thought to depend on the lattice energy. It is pointed out here that these relationships must be accurately established. The electrical strength of the dielectric is thought to increase with an increase in the lattice energy (Fig. 10). Other properties, such as the thermal resistance of the

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ionic crystals are in a reverse relationship to the lattice energy, but this phenomenon is assumed to be illusionary, since the decomposition of these substances is also determined by the ionization potential, as well as the lattice energy. The reverse relationship is also observed in the case of the heterodesmic structures. Data obtained from Refs. 9, 10 on a comparison of the physico-chemical properties of liquid and gaseous organic dielectrics with their electrical strength in the aliphatic hydrocarbon series showed that the electrical strength changes sympatically with the change in the intermolecular bond strength and does not depend on the bond strength within the molecule. These results were used to form a graph of the spark-over of the organic dielectrics (Fig. 11). Further mention is made of the connection between the physico-chemical properties of dielectrics and the lattice energy when the structure is destroyed. The contraversial facts noted in real crystals, viz., the mechanical properties of these single crystals changing according to certain rules with the change in the lattice energy, are explained by the behavior of the defects, especially of dislocations, i.e., by the energy of the crystal lattice. One of the possible means for obtaining a controllable concentration of the defects in the lattice is the formation of solid solutions. Upon investigating the electrical properties of the solid

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solutions $CaO-ZrO_2$, a defect in their structure was noted (Ref. 47). A complex investigation of the physical properties of the solid solutions KCl-RbCl, KCl-KBr, NaCl-NaBr was carried out. It was proven that the general characteristic, which determines the physical properties of a complex dielectric, was the heat of formation. It is expected that a drop in the interaction forces would involve a drop in the strength and an increase in the defect of the solid solution. The relationship between the heat of formation of the solid solution and the average number of particles n included in the volume of the elementary nucleus (for an ideal single crystal n = 8) leads to the conclusion that the more heat absorbed in the formation of the solid solution, i.e., the lower the energy of interaction of the particles in the crystal lattice of the crystal, the more defective is its structure. The connection between the defectiveness of the structure and the lattice energy leads the authors to assume that the laws obtained for the single crystals are also applicable to the polycrystals used commercially. Finally, the authors discuss the connection between the physico-chemical properties of solid solutions of alkali-halide salts. It is said that the introduction of admixtures into the crystal can lead to a change in the interaction between the particles of the crystal lattice of the substance. Experimental data on the physico-chemical

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Physico-Chemical Problems of Dielectrics

properties of solid solutions of ionic compounds are compared and certain assumptions are therefrom derived on the interaction of ions in the investigated systems. The most important value characterizing solid solutions is their heat of formation and reference is made to the formula used by Grimm (Ref. 61) for calculating the energy of the crystal lattice. The heat of formation of the solid solution is estimated experimentally as the difference between the heats of dissolution of the solid substance and the mechanical mixture of components having the same weight and composition. The connection between the heat of formation and the electrical properties of the alkali-halide solid solutions is noted. The electrical strength of NaCl-NaBr, KBr-KJ, KCl-KBr, NaBr-KBr is lower than that of the components. Solid solutions formed by heat absorption have a weakened structure and are characterized by a lowered electrical, schematic and thermal strength, high dielectrical losses and a defective structure. The electrical characteristics of dielectrics are connected with other properties, e.g., in the case of ionic crystals with the lattice energy, in homeopolar crystals with the energy of atomization, in molecular crystals with the energy of intermolecular bonds and in solid solutions with the amount of heat liberated in their formation. All these values are the higher, the higher the mechanical, thermal, chemical and elec-

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Physico-Chemical Problems of Dielectrics

trical strength of the dielectrics. The authors point out that in selecting new materials for dielectrics compounds with highly-charged atoms (boron, silicon, etc.), should be combined with non-deforming atoms creating rigid bonds (nitrogen, fluorine, etc.). It is worthwhile to investigate the possibilities of using temperatures and pressures obtained in explosive processes and electrical explosions when producing dielectrics to overcome the high activation barriers of the reaction. The problem of selecting new dielectrical materials is a matter for the chemist, as well as the physicist. There are 15 figures, 4 formulae, 1 table and 81 references: 62 Soviet, 12 English, 6 German, 1 unidentified.

Card 9/17

MELIK-GAYKAZYAN, I.Ya.; TRESKINA, M.N.; ZAVADOVSKAYA, Ye.K.

Half-width of the F-band and density of the F-centers in solid solutions of KCl-KBr monocrystals. Opt. i spektr. 9 no. 6:782-784 D '60. (MIRA 14:1)

(Potassium chloride crystals--Spectra)
(Potassium bromide crystals--Spectra)

VOROB'YEV, A.A., prof.; ZAVADOVSKAYA, Ye.K., prof.; BOLDYREV, V.V., kand.khimicheskikh nauk; MELIK-SAYKAZYAN, I.Ya., kand.fiziko-matematicheskikh nauk; SAVINTSEV, P.A., kand.fiziko-matematicheskikh nauk

Physicochemical aspects of dielectrics. Zhur. VKHO 5 no. 5:573-582 '60. (MIRA 13:12)

(Dielectrics)

MELIK-GAYKAZYAN, I.Ya.; ZAVADOVSKAYA, Ye.K.; TRESKINA, M.N.

Distribution of impurities in crystals of alkali halide salts. Kristallografiia 5 no.3:477-478 '60. (MIRA 13:8)

1. Tomskiy politekhnicheskiy institut im. S.M.Kirova.
(Alkali halide crystals)

85050

24.7200 (104/3,1106,1385) S/051/60/009/006/012/018
E201/E191

AUTHORS: Melik-Gaykazyan, I.Ya., Treskina, M.N., and Zavadovskaya, Ye.K.

TITLE: The F-Band Half-Width and the Density of F-Centres in Monocrystalline KCl--KBr Solid Solutions

PERIODICAL: Optika i spektroskopiya, 1960, Vol.9, No.6, pp 782-784

TEXT: Several workers (Refs 3-5) studied imperfections in solid solutions of alkali halides. The degree of imperfection was taken to be represented by the difference between the density measured by weighing and the density deduced from X-ray diffraction crystallography. If the imperfections are all Schottky defects (vacancies), then the maximum of the degree of imperfection should occur at the same composition at which the half-width of the F-band is greatest. This was found to be true in KCl--KBr crystals (Ref.5): the maxima of the F-band half-width (Ref.1) and the number of Schottky defects both occurred at 60 mol.% RbCl in KCl. The present paper deals with KCl--KBr crystals grown from solution and from melt. It was found that the maximum of the Schottky defect density (χ_v) occurred at about 80% KBr, compared with the

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The F-Band Half-Width and the Density of F-Centres in Monocrystalline KCl--KBr Solid Solutions

maximum of the F-band half-width (γ) which was at about 70% KBr (Fig.1). It was also found that the density of F-centres (n_o) had a maximum at about 50% KBr and minima at 20% and 90% KBr (Fig.2). The value of n_o was lower in KBr--KCl solutions than in pure KBr or in pure KCl, due to the lower stability of F-centres in solid solutions (a table on page 783).

Acknowledgements are made to V.V. Boldyrev and A.D. Shchelokov for their advice.

There are 2 figures, 1 table and 6 references: 2 Soviet, 2 English, 1 German and 1 translation from English into Russian.

SUBMITTED: May 3 , 1960

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MELIK-GAYKAZYAN, I.Ya.; ZAVADOVSKAYA, Ye.K.; TRESKINA, M.N.

Effect of firing on the absorption spectra and electric conductivity of the crystallophosphors NaCl-Pb and KCl-Pb. Opt.i spektr. 9 no.1:83-85 Jl '60. (MIRA 13:7)
(Phosphors--Spectra)
(Phosphors--Electric properties)

VOROB'YEV, A.A.; ZAVADOVSKAYA, Ye.K.; IVANKINA, M.S.; SAVINTSEV, P.A.

Physical properties of solid solutions of alkali halide compounds, and the molecular concentration. Izv.vys.ucheb.zav.; fiz. no.6:162-165 '59. (MIRA 13:6)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Alkali metal halides) (Solutions, Solid)

ZAVADOVSKAYA, YE. K.

81959
S/181/60/002/04/19/034
B002/B063

24.7600
AUTHORS: Zavadovskaya, Ye. K., Ivankina, M. S., Melik-Gaykazyan, I. Ya.

TITLE: The Problem of the Influence of Annealing on the Physical Properties of Solid Solutions of Alkali Haloid Salts

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 4, pp. 665-669

TEXT: Mixed crystals composed of 51% KCl and 49% KBr, as well as 49.3% NaCl and 50.7% NaBr were bred by Kyropoulos' method. The crystals were kept at 600°C for 5, 10, 20, 25, 50, and 75 hours; the temperature was kept constant with an accuracy of ± 2°C with the aid of the recording device ЭПП-09 (EPP-09). The following was then measured on the crystals: density, lattice constant, molecular concentration, linear expansion coefficient, and heat conductivity (Tables 1 and 2). The cleavage faces of the crystals were examined with the aid of a polarization microscope and the camera "Зенит" ("Zenit") (Figs. 1, 2, and 3). On heating, the vacancies are concentrated and form negative crystals inside. The faces {100} and {110} are particularly developed. Cleavage cracks are the cause of the

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resulting pores which are aligned in one row (Fig. 3). Since the vacancies migrate also to the free crystal surface, a longer heating also leads to a slight increase in density. The temperature dependence of the electrical conductivity of a K(Cl,Br) crystal was also determined. The said crystal was heated four times successively (Fig. 4). After each heating, conductivity rose further. This is possibly also due to the pore formation. Mention is made of papers by R. I. Garber, L. M. Shamovskiy, and Ya. Ye. Geguzin. There are 4 figures, 2 tables, and 9 references: 8 Soviet and 1 British.

ASSOCIATION: Tomskiy politekhnicheskiy institut
(Tomsk Polytechnic Institute)

SUBMITTED: June 16, 1959

ZAVADOVSKAYA, Ye.K.; IVANKINA, M.S.

Effect of the length of storage of solid solutions of alkali halide salts on their physical properties. Izv. vys.ucheb.zav.; fiz. no.5:172-175 '59. (MIRA 13:4)

1. Tomskiy politekhnicheskiy institut imeni S.M.Kirova.
(Solutions, Solid) (Alkali halides)

15-57-1-507

Translation from: Referativnyy zhurnal, Geologiya, 1957, Nr 1, p 82 (USSR)

AUTHOR: Zavadovskaya, Ye. K.

TITLE: Relationship Between Lattice Energy and the Physical-Chemical Properties of Single Crystals of Cesium Chloride, Wurtzite, Zinc Blende, and Rutile (Svyaz' mezhdu energiyey reshetki i fiziko-khimicheskimi svoystvami monokristallov tipa khloristogo tseziya, vyurtsita, tsinkovoy obmanki i rutila)

PERIODICAL: Izv. Tomskogo politekhn. in-ta, 1956, Vol 83, pp 251-255.

ABSTRACT: The relationship of lattice energy to valence and ionic radius in ionic crystals is expressed by the equation of A. F. Kapustinskiy. A relationship is to be expected between the properties of crystals and the value of lattice energy in ionic crystals having different types of lattice. Such relationships were found for combinations crystallizing with the lattice type of fluorite,

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Relationship Between Lattice Energy and the Physical- (Cont.)

cesium chloride, wurtzite, and zinc blende. A graph showing relationship of molecular volume to lattice energy for these minerals shows that the lattice energy, as in lattices of the NaCl type, increases with reduction in molecular volume and ability to polarize of the compound. The largest values of lattice energy are found in combinations that crystallize in lattices of the wurtzite type; the smallest values belong to crystals with a cesium-chloride lattice. A complication in the crystal lattice is accompanied by increase in lattice energy. In the investigated group of compounds, the physical properties change with a change in lattice energy, in a manner similar to the group of alkali-halogen crystals of halite type. The indices of refraction for crystals of the fluorite type decrease with increase in lattice energy. With the same cation, the index of refraction and the ability to polarize are less in fluorides than in chlorides. The fusion temperature of alkali-halogen compounds with lattices of the cesium-chloride type increases with increase in lattice energy. In crystals with lattice of the fluorite and cesium-chloride type, the specific heat increases with increase in lattice energy, as it does for alkali-

Relationship Between Lattice Energy and the Physical- (Cont.)

halogen salts with lattices of the halite type. The lattice energy of crystals with the different lattice types increases with increase in heat of formation of the compound. The results obtained permit one to broaden the laws concerning the changes of physical-chemical, thermal, and electrical properties, according to changes in lattice energy observed in crystals of the halite type, to encompass ionic crystals with lattices of two types. Such a generalization may be very useful; for example, for considering the isolation of materials for a certain value of lattice energy and, consequently, for preparing a dielectric with definite properties.

A. A. L.

Card 3/3

ZAVADOVSKAYA, Ye.K.

Defective ion conductivity of alkali metal halides in solid solutions. Izv. vys. ucheb.zav.; Fiz. no.1:63-67 '58. (MIRA 11:6)

1.Tomskiy politekhnicheskiy institut imeni S.M. Kirova.
(Alkali halide crystals--Electric properties) (Solutions, Solid)

ZAVADOVSKAYA, Ye. K. (TPI) Docent

"The character of the dependence of the electric conductivity of solid solutions on the composition in the case of temperature variation is determined by the interaction forces of the ions in the crystal"

Report presented at a Conference on Solid Dielectrics and Semiconductors, Tomsk Polytechnical Inst., 3-8 Feb. 58.
(Elektrichestvo, '58, No. 7, 83-86)

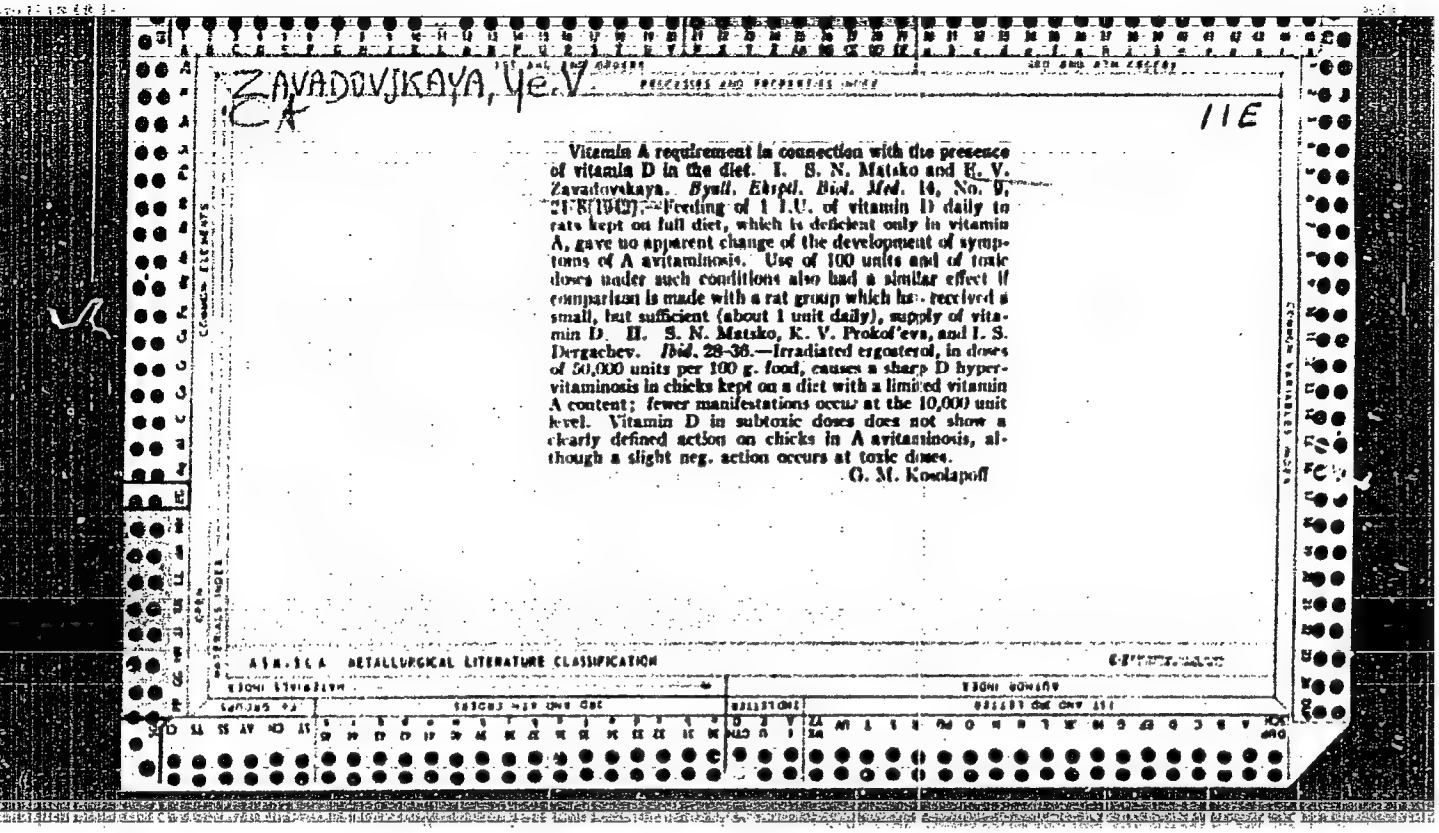
ZAVADOVSKAYA, Ye.K.; IVANKINA, M.S.; MELIK-GAYKAZYAN, I.Ya.

Effect of annealing on the physical properties of solid solutions of alkali halide salts. Fiz. tver. tela 2 no.4:665-669 Ap '60. (MIRA 13:10)

1. Tomskiy politekhnicheskiy institut.
(Alkali halide crystals)

MELIK-GAYKAZYAN, I.Ya.; ZAVADOVSKAYA, Ye.K.

Relation between the F-band half-width of solid solutions of alkali halide crystals and their defectiveness. Opt.i spektr. 9 no.4: 516-517 O '60. (MIRA 13:11)
(Alkali halide crystals--Spectra)



ZAVADOVSKAYA, Ye.V.

CA

11E

Vitamin A requirement in connection with the presence of vitamin D in the diet. I. S. N. Matsko and E. V. Zavadovskaya. *Byull. Eksptl. Biol. Med.* 14, No. 9, 21-5(1942).—Feeding of 1 I.U. of vitamin D daily to rats kept on full diet, which is deficient only in vitamin A, gave no apparent change of the development of symptoms of A avitaminosis. Use of 100 units and of toxic doses under such conditions also had a similar effect if comparison is made with a rat group which has received a small, but sufficient (about 1 unit daily), supply of vitamin D. II. S. N. Matsko, K. V. Prokof'eva, and I. S. Dergachev. *Ibid.* 28-36.—Irradiated ergosterol, in doses of 50,000 units per 100 g. food, causes a sharp D hypervitaminosis in chicks kept on a diet with a limited vitamin A content; fewer manifestations occur at the 10,000 unit level. Vitamin D in subtoxic doses does not show a clearly defined action on chicks in A avitaminosis, although a slight neg. action occurs at toxic doses.

G. M. Kosolapoff

ZAVADOVSKAYA, Ye. V.

"On the Antagonism between Vitamins A and C," Biokhim., 11, No. 1, 1946.

Mbr., State Control Vitamin Sta., People's Commissariat Health,-1946-.

ZAVADOVSKAYA, Ye.V.
CA

11E

Effect of carotene, vitamin C, and nicotinic acid on the development of D-hypervitaminosis. S. N. Matsko and E. V. Zavadovskaya (State Vitamin Control Sta., Moscow). *Farm. Zhur. S.S.S.R.* 37, 233–9(1951).—Expts. with rats in which carotene, vitamin D, irradiated ergosterol, vitamin C, and nicotinic acid are used in the diet showed that carotene has an antitoxic action in respect to excess irradiated ergosterol, by hindering the symptoms of D-hypervitaminosis and by lengthening the life expectancy of the animals. The minimal dose of carotene that causes such action is much above the min. prophylactic dose and an increase of the dosage leads to greater antitoxic action. Neither ascorbic acid nor nicotinic acid had such an effect. Generally a dose of 24–47 international units of carotene is necessary for clear-cut results. G. M. Kosolapoff

SEPPI, I. V., podpolkovnik meditsinskoy sluzhby, kand. med. nauk;
ZAVADOVSKIY, A. I., polkovnik meditsinskoy sluzhby, kand. med. nauk

"Materials of the Fourteenth Extended Session of the district military hospital of the Moscow Military District." Reviewed by I. V. Seppi, A. I. Zavadovskii. Voen.-med. zhur. no.12: 76-77 D '61. (MIRA 15:7)

(HEMORRHAGIC FEVER)

VASHKOV, V.I.; CHISTOVICH, G.N.; ZAVADOVSKIY, A.I.

Brief news. Zhur. mikrobiol., epid. i immun. 40 no.3:153-156 Mr '63. (MIRA 17:2)

ZAVADOVSKIY, A.I.; SEPPI, I.V.; SINYAK, K.M.; YEZHOVA, N.G.

Some results of study of natural-focus infectious diseases in the western Ukrainian provinces during the period of Soviet rule. Zhur.mikrobiol.epid.i immun. 31 no.2:61-65 F '60. (MIRA 13:6)

(COMMUNICABLE DISEASES epidemiology)

ZAVADOVSKIY, A.I., polkovnik med.sluzhby, kand.med.nauk

Prevention of Salmonella infections caused by food. Voen.med.zhur. no.9:47-51 S '57. (MIRA 11:3)

(SALMONELLA INFECTIONS, prevention and control, food pois.(Rus)

ZAVADOVSKIY, A.I. (L'vov)

Terminology and classification of food toxinfections and poisoning. Vop.pit. 15 no.5:53-56 S-O '56. (MLRA 9:11)
(FOOD POISONING,
terminol. & classif. (Rus))

ZAVADOVSKIY, A. I.

Clinical Phenomena of Acute Dysentery.

VOYENNO-MEDITSINSKIY ZHURNAL(MILITARY MEDICAL JOURNAL), No 3, 1955. p. 40

ZAVADOVSKIY, A.I.

Regional academic and practical conference on the problems of medical geography in the city of Lvov. Izv. Vses. geog. ob.-va 97 no.2:203-204 Mr-Ap '65. (MIRA 18:5)

ZAVADOVSKII, A. I.

20106 ZAVADOVSKII, A. I. Ob osobennostyakh klinicheskoye kartiny toksikoinfektsiy, antibiotikov v. profilaktike skarlatiny. Vracheb. delo, 1949, No. 6, stb. 549-50.

SO: LETOPIS ZHURNAL STATEY, Vol. 27, Moskva, 1949.

ZAVADOVSKIY, A. M.

AID P - 2869

Subject : USSR/Engineering

Card 1/1 Pub. 110-a - 2/16

Author : Zavadovskiy, A. M., Kand. Tech. Sci.

Title : Influence of certain design elements upon turbine stage characteristics

Periodical : Teploenergetika, 10, 9-13, O 1955

Abstract : Results of experiments made with MGT-1 and MGT-2 one-stage turbines on axial and vertical gaps between wheels and diaphragms. Experimental data are given in detail and a mathematical analysis is included. Eleven diagrams.

Institution : Central Boiler and Turbine Institute

Submitted : No date

ZAVADOVSKIY, A. M.

PERIODICAL ABSTRACTS

Sub.: USSR/Engineering AID 4153 - P

ZAVADOVSKIY, A. M.

K VOPROSU O RASCHETE PORSHNEVYKH GENERATOROV GAZA GAZOTURBINNYKH USTANOVOK (On designing piston compressors in gas turbine units). Teploenergetika, no. 1, Ja 1956: 29-35.

A theoretical analysis of the various processes which occur in piston compressor operating under varying working conditions. A simplified method for their computation and design is presented. Eleven diagrams.

ZAVADOVSKIY, A.M., kandidat tekhnicheskikh nauk.

Determining the ranges of transition from cylindrical to twisted blading in the stages of steam and gas turbines. Energomashinostroenie no.8:13-15 Ag '56. (MLRA 9:10)

(Steam turbines--Blades) (Gas turbines--Blades)

ZAVADOVSKIY, A.M.

114-8-8/16

AUTHOR: Zavadovskiy, A.M., Candidate of Technical Sciences.

TITLE: The influence of gaps at the butts of shroud segments of working wheels on the characteristics of turbine stages.) (Vliyaniye shcheley v stykakh segmentov bandazhey rabochikh koles na kharakteristiki turbinnykh stupeney)

PERIODICAL: "Energomashinostroyeniye"(Power Machinery Construction), 1957, Vol.3, No.8, pp. 26 - 27 (U.S.S.R.)

ABSTRACT: In steam and gas turbines the blade shrouds on the runners are made up of segments between which gaps are left. The number of gaps on a wheel depends on the numbers of packets of blades, and on some gas turbine blades, when the shroud is made integral with the blade, the number of the gaps is the same as the number of blades.

These gaps cause power losses about which very little has been published. There is experimental evidence that the losses may be quite appreciable when the blades are short. A brief mathematical analysis of the question is given. Tests were made, first with a continuous shroud on the wheel; the test results were used to plot the efficiency curves shown in Fig. 2. The shroud was then cut into sixteen segments with gaps 1.0 mm wide. The tests were repeated, and the results plotted in Fig. 3, show that in this case the maximum efficiency

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The influence of gaps at the butts of shroud segments of the working wheels on the characteristics of turbine stages. (Cont.) 114-8-8/16

was 0.5% lower than before. Increase in the gap width to 1.5 mm caused a further appreciable drop in efficiency.

The losses are a result of very complex effects due to flow of working medium from the blde channels through the gaps, and also to change of the flow structure in the channels. It was not possible to calculate the losses. However, they could be easily evaluated from experiments as shown in Fig.4. It is concluded that the influence of the gaps in the shrouds on the stage of efficiency is practically equivalent to the influence of the axial gap between the shroud and the diaphragm. In the present tests the degree of reaction changed very little.

There are 4 figures and 1 Slavic reference.

AVAILABLE: Library of Congress

Card 2/2

AUTHOR: Zavadovskiy, A.M. (Cand. Tech. Sc.) (Central Boiler-Turbine Institute).

TITLE: Relationships that characterise the throughput capacity of a turbine stage. (Zavisimosti kharakterizuyushchiye propusknuyu sposobnost' turbinoy stupeni).

PERIODICAL: "Teploenergetika" (Thermal Power), Vol.4, No.4, April, 1957, pp.6-10. (U.S.S.R.)

ABSTRACT: One of the main aerodynamic characteristics used in the design of the flow part of steam and gas turbines is the relationship that characterises the throughput capacity of a stage when the working medium passes through it. This capacity depends on many factors. This article presents a method of determining the relationships that characterise the throughput of a turbine stage and a functional relationship is established between the main aerodynamic characteristics of the stage. A formula is given for the flow factor which is the ratio of the actual to the theoretical flow. Corresponding expressions are given for the fixed and working blading. The method of determining the theoretical flow is presented on the assumption that the theoretical velocity corresponds to the total heat drop on the stage and the flow area is equal to the narrow section of the channels between the blades. The most reliable data on the throughput characteristics are

Relationships that characterise the throughput capacity of a turbine stage. (Cont.) 251

obtained by tests on actual turbine stages. This necessitates detailed investigation of the flow before and after each blade along the pitch and height of the blades with subsequent averaging. This method is very complex and laborious. It is particularly difficult to determine the area of the channels with sufficient accuracy when the outlet angles are small. It is much easier to make the measurements under static conditions than in an experimental turbine but the flow factors determined in this way require correction. Several formulae are given to facilitate determination of the flow passing capacity of a stage. The relationship that is established between the main aerodynamic characteristics of stages makes it possible to use two total characteristics of a turbine stage to find the third. The practical results that can be obtained from tests on stages in experimental turbines are explained.
No figures, no literature references.

645

AUTHOR: Zavadovskiy, A.M., Candidate of Technical Sciences (Central Boiler and Turbine Institute).

TITLE: On the selection of the degree of reaction in the stages of high pressure steam turbines. (O vybore stepeni reaktsii v stupenyakh vysokogo davleniya parovykh turbin.)

PERIODICAL: "Teploenergetika" (Thermal Power), 1957, Vol. 4, No. 6, pp. 40 - 42 (U.S.S.R.)

ABSTRACT: The high pressure stages of steam turbines have high D/l ratios so that simple blade forms can be used. Blade heights are small so that a considerable proportion of the power losses in a stage consists of flow boundary losses. Therefore, in designing turbine stages with short blades account must be taken of steam leakages round the blades.

With a small value of reaction on the design diameter (usually the mean diameter) the degree of reaction on the peripheral diameter will be small and leaks at the shrouds will be small. However, the blade root is then working in unfavourable conditions of negative reaction. In view of the complexity of the effects that take place in the flow part of a turbine, particularly when there is negative reaction and inflow of steam, an experimental investigation was made on one type of blading. The object of study was a stage with cylindrical blading and profiles types TH-2 and T-2. The height of the guide blades was 30 mm, the height of the working blades 34 mm, the mean wheel diameter 433 mm. The overlap at the shroud was 3 mm and the overlap on the internal diameter 1 mm. The width

On the selection of the degree of reaction in the stages of high pressure steam turbines. (Cont.)

of the guide blades was 35 mm and of the working blades 20 mm. The tests were made in the Central Boiler-Turbine Institute on an experimental air turbine type MVT-2. To cause leakage-in of air the chamber before the wheel was connected through a throttling valve to the working-medium supply pipe. For the case of leakage-out the working wheel chamber was connected to atmosphere.

The experiments revealed the influence on the stage efficiency of losses caused only by reaction and leakage through the clearances. The results are plotted on a graph which shows the change in the maximum efficiency of the stage (without using the exit velocity) and the reaction on the mean diameter as functions of the reaction on the root diameter for various values of leakage-in. The curves show that in the type of stage considered there is an optimum maximum value of stage reaction the position of which depends on the amount of leakage-in. The curves also show that for small values of reaction (less than the optimum) the leakage-in of air considerably reduces the stage efficiency. Above the optimum value increased leakage-in of air reduces the losses due to interaction of the incoming and main flows.

A further graph of the change in the maximum value of the stage efficiency (when the exit velocity is used) as function

On the selection of the degree of reaction in the stages of high pressure steam turbines. (Cont.)

of the reaction at the root diameter shows that in this case the change in the efficiency is of the same character. When there is negative reaction the flow of medium leaking-in changes in direction and is accelerated at the expense of the energy of the main flow. If the reaction is positive, the gain in speed is partly the result of pressure drop, but in this case too the air leaking in reduces the efficiency. This is shown in curves of change of stage efficiency (without using outlet velocity) as function of the reaction at the root diameter. Unlike the previous graph, these curves reflect, in addition to the effect of the leaking-in on the main flow, the loss of efficiency that results from diminution of the main flow by the amount of leakage.

In order to investigate effects in the zone of negative reaction, visual observations were made of the flow in the gap between the guide blades and the working wheel. A special device was designed and made for this purpose, which consisted of observation windows, a lighting apparatus and probes with fine threads. The attitude of the thread in the flow could be seen. In none of the experiments was reversed flow observed; in regions of negative reaction there was only more turbulence.

The influence of leakage-out of air on the stage characteristics was investigated when the leakage did not exceed 0.5%. The data are plotted in a graph, and show that such a small

On the selection of the degree of reaction in the stages of high pressure steam turbines. (Cont.)

The following practical conclusions may be drawn from the work: for turbine stages with short blades there is an optimum value of reaction which depends mainly on leakage through the gap at the peripheral diameter of the stage and also on leakages in and out through the root diameter of thestage. The optimum working conditions of a turbine stage with short blades occur when the reaction is positive over the entire height of the blades. The amount of leakage-in has an important influence on the selection of the best value of stage reaction. Leakage-out of working medium through the slot at the root diameter in small amounts (less than 0.5%) had no important influence on the optimum value of stage reaction or on the stage efficincy.

6 figures, no literature references.

AVAILABLE:

Card 4/4

Zavadovskiy, A.M.

ZAVADOVSKIY, A.M., kand.tekhn.nauk; BABENKO, Kh.L., inzh.

Note on the publication of the Central Scientific Research Institute for Boilers and Turbines entitled "Directives on aerodynamic calculation of the blading in stationary gas turbines." Energomashinostroenie 3 no.12:43 D '57. (MIRA 11:1)

(Gas turbines)

ZAVADOVSKIY, A.M.

ZAVADOVSKIY, A.M., kand. tekhn. nauk; BABENKO, Kh.L., inzh.

The effect of licks on the operation of a turbine stage. Teploener-
getika 5 no.1:28-31 Ja '58. (MIRA 11:1)

1. TSentral'nyy kotloturbinny institut.
(Turbines)

ZAVADOVSKIY, A.M., kand.tekhn.nauk; BERLOVICH, A.L., inzh.

Study of the cascade of profiles of a turbine. Teploenergetika 12 no.10:63-68 O '65. (MIRA 18:10)

1. TSentral'nyy kotloturbinnyy institut.

L 31465-66 EWP(f)/T-2/ETC(m) WW

ACCESSION NR: AP5024138 UR/0096/65/000/010/0063/0068

621.165.533.6.001.24

AUTHOR: Zavadovskiy, A. M. (Candidate of technical sciences); Berkovich, A. L. (Engineer)

TITLE: Some questions in the investigation of grids of turbine profiles

SOURCE: Teploenergetika, no. 10, 1965, 63-68

TOPIC TAGS: turbine design, thermodynamics, steam turbine

ABSTRACT: To work out methods for the design and calculation of elements for the flow through section of a low pressure condensing turbine, it is necessary to create a series of high efficiency profiles for the guiding and operating vanes. An important part of this work is the perfecting of profile grids in special steam tubes. The article gives a survey of the basic problems involved in the modelling of a process involving flow plast profile grids. The article first derives an expression for the loss coefficient in the superheated steam region. This is a measure of the power characteristics of the grid. The article goes on to consider the case where the process in the grid begins in the superheated steam region and ends in the wet steam region. Thermodynamic considerations lead to an express-

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ACCESSION NR: AP5024138

3

ion for determination of the heat loss across an element of the grid area. Results show that the direction of the water and the steam in fixed grids and in operating vanes approximately coincide. This makes it possible to determine the angle of exit of the stream. The final expression derived for the loss coefficient characterizes the throughput capacity of the profile grid without the influence of end effects. Orig. art. has: 16 formulas and 3 figures

ASSOCIATION: Tsentral'nyy kotloturbinnyy institut (Central Boiler Turbine Institute)

SUBMITTED: 00 ENCL: 00 SUB CODE: PR, ME

NR REF SOV: 004 OTHER: 001

Card 2/2

ZAVADOVSKIY, A.M., kand. tekhn. nauk; BABENKO, Kh.L., kand. tekhn. nauk

Method for designing partial turbine stages. Energomashinostroenie 10 no.6:23-24 Je '64. (MIRA 17:9)

ZAVADOVSKIY, A.M., kand.tekhn.nauk; ZHUKOVSKIY, G.V., inzh.

Series of stages of a gas turbine system with large flow output angles. Izv. vys. ucheb. zav.; energ. 6 no.7:56-61 Jl '63. (MIRA 16:8)

1. TSentral'nyy kotloturbinnyy institut imeni I.I.Polzunova.
(Gas turbines)

ZAVADOVSKIY, A.M., kand.tekhn.nauk

Effect of the pitch and angle of the guiding blades on the operation of a turbine stage. Teploenergetika 8 no.4:28-30 Ap '61. (MIRA 14:8)

1. TSentral'nyy kotloturbinnyy institut.
(Turbines)

87964

S/114/60/000/007/005/009
E194/E455

26.2120

AUTHORS: Zavadovskiy, A.M., Candidate of Technical Sciences, Babenko, Kh.L., Engineer and Agafonov, V.A., Engineer

TITLE: Formation of the Flow Path of a Turbine by Undercutting Blades of the Initial Stage

PERIODICAL: Energomashinostroyeniye, 1960, No.7, pp.19-21

TEXT: Work of the Central Boiler Turbine Institute has shown that in forming and designing the flow paths of turbines, it is advisable to proceed by the method of model stages. In this method, the initial stage is modified by undercutting the runner blades from the periphery and the guide vanes from the shaft end. The pitch of the guidevanes at the mean diameter is maintained constant. This method may be applied to a stage, to a group of stages, or even to a turbine as a whole. Before a stage can be used as an initial stage, certain information is required about its performance and design characteristics. The characteristics of the initial stage and the corrections to them resulting from undercutting can, in principle, be calculated or determined by a test on a rotating turbine, which is very much more satisfactory

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Formation of the Flow Path of a Turbine by Undercutting Blades of the Initial Stage

in the present state of knowledge. Similarly, it is currently desirable to create a series of initial stages to satisfy the requirements of steam and gas turbine design. This article gives information about one of the initial stages developed in the Central Boiler Turbine Institute and shows that under certain conditions, considerable changes may be made in the geometrical dimensions of the initial stages without appreciable change in the efficiency, flow characteristics, reaction and other characteristics. The initial stage has cylindrical guide vanes and corresponds closely to profile TN-2 (TN-2) of the Central Boiler Turbine Institute. The runner blades are twisted; Fig.1 shows their profiles at five sections along the height. During the course of the tests, the runner blades were shortened from the top, while the number of blades and angle of installation remained unaltered. Correspondingly, the free ends of the guide vanes were cut off. Geometrical data about the stages used are tabulated. The runner blades were unshrouded but both ends of the guide vanes were let into the turbine frame, so that there were no leaks between them

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Formation of the Flow Path of a Turbine by Undercutting Blades of the Initial Stage

and the rotor. During the course of the investigations of each individually-produced stage, the angle of installation of the guide vanes was altered several times. The results of the tests are plotted in Fig.2 to 8, curves being given of efficiency, change of total pressure, change of reaction along the radius, change of efficiency as a function of gap between the rims, and others. The uniform pressure distribution beyond the discharge from the stage signifies that the stage investigated will be of high efficiency even when it is used as an intermediate stage over a wide range of velocity ratios. Numerous data on efficiency obtained when testing stages newly-formed by undercutting blades with the same angle of installation of the guide vanes showed that the efficiency commences to drop only when the blades are very short. The tests showed that undercutting the blades could increase the reaction, but this could be reduced to the optimum value by altering the angle of installation. The maximum value of stage efficiency is plotted

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Formation of the Flow Path of a Turbine by Undercutting Blades of the Initial Stage

as a function of the closed axial gap and the shape of the curve confirms the existing opinion that two main factors are particularly important in this case, namely the influence of variations in flow before the runner rim and losses due to friction in the angular surfaces. It is concluded that this method of forming the flow paths of turbines is simple and easy to make. It should afford the possibility of introducing extensive standardization of turbine stages. There are 8 figures, 1 table and 1 Soviet reference.

Card 4/4

PHASE I BOOK EXPLOITATION SOV/5093

Zavadovskiy, Anatoliy Mikhaylovich

Osnovy proyektirovaniya protochnoy chasti parovykh i gazovykh turbin (Fundamentals of Designing the Flow-Passage Area of Steam and Gas Turbines) Moscow, Mashgiz, 1960. 246 p. Errata slip inserted. 4,000 copies printed.

Reviewer: I. L. Povkh, Professor, Doctor of Technical Sciences; Ed.: K. G. Rodin, Candidate of Technical Science; Ed. of Publishing House: Ye. K. Gofman; Tech. Ed.: L. V. Shchetinina; Managing Ed. for Literature on the Design and Operation of Machines (Leningrad Branch, Mashgiz): F. I. Fetisov, Engineer.

PURPOSE: This book is intended for engineers engaged in designing, producing, and operating steam and gas turbines. It may also be useful to students in technical schools of higher education.

COVERAGE: The book describes modern methods of designing and calculating the flow-passage area of steam and gas turbines. These methods are based on theoretical and experimental material obtained

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Fundamentals of Designing (Cont.) SOV/5093

in investigations of airfoil cascades in wind tunnels and of stages in experimental turbines. The influence of some design parameters on the aerodynamic characteristics of stages and considerations on improving the flow-passage area are discussed. The Tsentral'nyy nauchno-issledovatel'skyy kotloturbinnyy institut imeni I. I. Polzunova (Central Scientific Research Institute for Boilers and Turbines imeni I. I. Polzunov) is mentioned. Kh. L. Babenko, Engineer, wrote sections 16, 24, 29, 30, and 31, and collaborated in writing Ch. IV. There are 57 references, all Soviet (including 4 translations).

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ZAVADOVSKIY, Anatoliy Mikhaylovich; Prinimal uchastiye BARENKO, Kh.L., inzh. POVKH, I.L., prof., doktor tekhn.nauk, retsenzent; RODIN, K.G., kand.tekhn.nauk, red.; GOFMAN, Ye.K., red.izd-va; SHCHETININA, L.V., tekhn.red.

[Principles of designing the blading of steam and gas turbines] Osnovy proektirovaniia protochnoi chasti parovykh i gazovykh turbin. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit.lit-ry, 1960. 246 p. (MIRA 13:12)
(Steam turbines--Blades) (Gas turbines--Blades)

ZAVADOVSKIY, A.M., kand.tekhn.nauk; BABENKO, Kh.L., inzh.; AGAFONOV, V.A., inzh.

Forming the blading by undercutting the blades of the initial stage. Energomashinostroenie 6 no.7:19-21 Jl '60. (MIRA 13:7)

(Turbines--Blades)

PHASE I BOOK EXPLOITATION SOV/4519

Gukasova, Yekaterina Aleksandrovna, Mikhail Isaakovich Zhukovskiy, Anatoliy Mikhaylovich Zavadovskiy, Larisa Mikhaylovna Zysina-Molozhen, Nikolay Akimovich Sknar', and Vsevolod Georgiyevich Tyryshkin

Aerodinamicheskoye soversheństvovaniye lopatochnykh apparatov parovykh i gazovykh turbin (Aerodynamic Improvement of Blading in Steam and Gas Turbines) Moscow, Gosenergoizdat, 1960. 340 p. Errata slip inserted. 4,000 copies printed.

Eds.: V.S. Zhukovskiy, Doctor of Technical Sciences, Professor, and S.S. Kutateladze, Doctor of Technical Sciences, Professor; Tech. Ed.: O.S. Zhitnikova.

PURPOSE: This book is intended for engineers working in turbine-construction plants, design offices, and power systems, and may also be used by aspirants and students of advanced courses in power-machinery construction at schools of higher education.

COVERAGE: The book discusses aerodynamic methods for investigating, profiling, and improving the blading of steam and gas turbines. Methods for calculating the potential flow about airfoil cascades and for determining energy losses on the basis

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of the boundary-layer theory are presented. Also discussed are methods for experimental study of the flow about blades in stationary cascades (with consideration of three-dimensional phenomena) and on rotating models. A special chapter (IX) treats the results of aerodynamic profiling of new blade cascades. The results presented are based on work performed at TsKTI imeni I.I. Polzunov. The authors thank Professor L.G. Loytsyanskiy for his advice. There are 124 references: 106 Soviet, 10 English, and 8 German.

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Aerodynamic Improvement of Blading (Cont.) SOV/4519

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Aerodynamic Improvement of Blading (Cont.) SOV/4519

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Aerodynamic Improvement of Blading (Cont.) SOV/4519

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ZAVADOVSKIY, A.M., kand.tekhn.nauk:

Selecting the reactivity for turbine stages. Teploenergetika 7 no.2:31-33 F '60. (MIRA 13:5)

1. TSentral'nyy kotloturbinnyy institut.
(Turbines)

SOV/96-60-2-5/24

AUTHOR: Zavadovskiy, A. M. Candidate of Technical Sciences

TITLE: Selection of the Reaction of Turbine Stages

PERIODICAL: Teploenergetika, 1960, Nr 2, pp 31-33 (USSR)

ABSTRACT: Previously, in designing turbine blading, including twisted blading, insufficient attention was paid to heat-drop distribution, and negative reaction was sometimes permitted in the blade roots. In present practice there is zero or slightly positive reaction at all blade roots when operating under design conditions; but it is still not certain whether the amount of reaction chosen is in fact the optimum and if so for what region. Consider the turbine blading illustrated diagrammatically in Fig 1a; if the degree of reaction is small, there will be little leakage through the peripheral gap δ, but there may be negative reaction at the root section attended by the usual undesirable consequences. If the stage reaction is increased, flow round the root part of the blades improves but leakage through the peripheral gap increases. Thus for stages with short blades, corresponding to Fig 1a, the optimum velocity ratio has a corresponding optimum

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Selection of the Reaction of Turbine Stages

range of reaction. Stages made according to the diagram on Fig 1b have no by-pass ducts such as are provided by the rotor disc apertures in the first case. Hence all steam passing through the diaphragm glands mixes with the main flow, altering the blade root conditions. This may somewhat modify the requirements of the blade root reaction. In stages with a drum-rotor, as illustrated in Fig 1b, a higher degree of reaction leads to greater peripheral leakages but the root leakages are reduced. The maximum stage efficiency with allowance for losses is given by expression (1). Suitable values of stage reaction may be calculated by expression (2); other formulae are given for calculating the reaction under various conditions. If the turbine flow path is made according to the diagram of Fig 1a, the influence of leakages on the stage efficiency may be evaluated from the curves of Fig 4 taken from the author's article in Teploenergetika, Nr 6, 1957. A numerical example of stage reaction calculation is then worked out. There are 4 figures and 6 Soviet references.

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AUTHOR: Zavadovskiy, A.M. (Candidate of Technical Sciences)

TITLE: The Selection of Overlap in Turbine Stages (O vybore perekryshi v turbinnykh stupenyakh)

PERIODICAL: Teploenergetika, 1959, Nr 6, pp 17-21 (USSR)

ABSTRACT: In turbine stages of the construction shown in Fig 1 the value of the end losses at the periphery depends on a number of factors, of which the most important are: the shape of the annular space (flow path) of the blading and the shape of the channels in the guide vanes; the length of the axial gap between the wheel shroud and the body of the diaphragm; the distance between the outlet edges of the guide vanes and the inlet edges of the blading; the value of the overlap, that is the amount by which the peripheral diameter of the blades exceeds that of the guide vanes; the axial overlap of the shroud; the angle of divergence of the flow beyond the guide vanes; and the values of the Reynolds and Mach numbers. Accordingly, the stage efficiency can be expressed by a relationship of the form of expression (1). This article considers the influence of stage geometry upon efficiency at sub-critical Mach numbers when the values of the

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Reynolds number are greater than 1 x 10^5 and optimum velocity ratio is maintained. A previous article by the same author (Teploenergetika 1955 Nr 10) showed that leakage through the open axial gap increases as the gap length increases, and diminishes as the overlap increases. However, excessive overlap impairs the flow conditions at the ends of the working blades and also lowers the efficiency. The flow leaves the guide vanes at an angle to a plane perpendicular to the machine shaft. Also, the flow is twisted by interaction between the flows from neighbouring channels. There is, therefore, a p ressure gradient along the blade radius and the flow expands more than it would in the absence of the twisting. Therefore, in a turbine stage, the amount of twisting of the flow beyond the guide vanes is the main factor that governs the angle of divergence of the active part of the flow before the runner. In selecting the amount of overlap it is necessary to ensure that, on the one hand, the leakage through the axial gap is as small as possible, and on the other hand, the flow conditions over the rim of the working blades at the peripheral diameter are

favourable. An expression is then given for the stage efficiency in terms of the axial gap, the overlap and the twisting of the flow. Formulae are developed that show the influence of various factors on the degree of twisting of the flow. A description is then given of the stage geometry and operating conditions used in making tests. The stage characteristics and best conditions are tabulated. The test results are plotted in Fig 2 in the form of curves of efficiency as a function of the number K , which is the ratio of the overlap to the product of the twisting of the flow and the axial gap. Graphs 2a, 2b and 2c correspond respectively to data of the Central Boiler Turbine Institute, the Neva Works, Leningrad, and the Bryansk Institute of Transport Engineering. The results show that for stages of the type investigated overlap has a favourable influence when K is between 0.7 and 0.8. It is concluded that the number K may be used to assess the optimum combination of axial gap, overlap, and twisting in turbine stages of the type shown in Fig 1 whose d/ℓ ratio is greater than 10. A graph of the reduction of stage efficiency due to the combined

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influence of axial gap and overlap as function of K is given in Fig 3, which may be used to determine the conditions under which overlap is unfavourable. This graph should not be used for stages with glands over the shrouding on the working blades because in this case the influence of overlap on the aerodynamic characteristics is much less.

There are 3 figures, 1 table and 3 Soviet references.

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AUTHORS: Zavadovskiy, A.M., Candidate of Technical Sciences
Babenko, Kh.L., Engineer

TITLE: A Method of Designing the Flow Parts of Steam and Gas Turbines (Metod proyektirovaniya protochnoy chasti parovykh i gazovykh turbin)

PERIODICAL: Teploenergetika, 1959, Nr 2, pp 23-28 (USSR)

ABSTRACT: It is not yet possible to calculate all the characteristics necessary for stage design and it is, therefore, recommended to use the so-called model stage method. An appropriate model stage is taken as the basis for designing a group of stages or, in some cases, the entire flow part of the turbine by making appropriate changes in the dimensions of the initial stage. The aerodynamic characteristics that are required of each model stage are stated in Eq (1) to (8). In addition, data should be available about the model stage from which the flow properties of the designed stages can be determined to a first approximation. It is important to include the necessary strength calculations at an early stage. The number of stages may be selected on the basis of identical heat drop on all the stages

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developed from a single model stage. The design of the flow part is developed by comparing different variants of change of diameters, heat drops and stage shapes subject to certain stated requirements. Eq (10) is derived for the isc-entropic heat drop on the stage with allowance for inlet velocity. The factors that govern the heat drop in the stage are easily seen from this formula. A design procedure is then recommended. The diameter and length of the last stage are determined from Eq (11) and the necessary approximate strength calculations are made. The number of stages is selected and a law of stage diameter ratio is taken. The various other characteristics that are required can then be determined. Finally the critical speed of the rotor is determined. Various other requirements that occur in the calculations are stated and finally a numerical example of a design is given. Typical blading performance curves that are required for the purpose of the calculations are given in Fig 1 and 2. The design of stages for variable operating

 conditions is then considered in a similar

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way, using the same basic equations. If model stages corresponding to the given conditions of operation are not available the design must be based on the velocity triangle method. As it is not possible to calculate all the losses in the flow part when the velocity triangle method of design is used, it is necessary to make use of experimental data obtained during tests on blading mounted on turbine wheels. Then it is not necessary to design each stage of the turbine anew but in this case too, the same principles can be adopted as are used in the model stage method. Here again, the total heat drop in the turbine is divided into several parts, each corresponding to a group of similar stages. A single stage is then designed for each group and forms a basis for the design of the rest of the group. The general principles are the same as in the previous methods. The formula necessary for design by this method is then given and typical curves required in the calculations are also given in Fig 4, 5 and 6. Expression (17) is used to determine the efficiency of

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the elementary stage. Further steps in the design procedure are explained and finally a numerical example of design is given. There are 6 figures and 3 Soviet references.

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